January 1994 Phase I remediation report: Love Springs

Consultant conducted two separate remedial actions at Love Springs.

This was the plan all along.

A magnetometer survey was done to identify buried drum locations.

Drums were excavated and sampled to determine disposal requirements.

Visually contaminated soils were excavated and stored in two piles

Report includes a count of various types of drummed waste and their analytical results.

1.0 INTRODUCTION

This Remedial Investigation (RI) Phase I Report (Phase I Report) for the Love Springs Site (Site) summarizes the actions taken by National Starch and Chemical Company (National Starch) to comply with the Administrative Consent Order 89-38-SW (AO) issued by the South Carolina Department of Health and Environmental Control (DHEC) The AO became effective on November 22, 1989, and was amended on July 6, 1993 (First Amendment). The AO and the First Amendment and the August 10, 1993 supplemental Scope of Work required by the First Amendment are presented in Appendix A.

Conestoga-Rovers & Associates (CRA) has prepared this Phase I Report on behalf of National Starch.

CRA prepared a RI Work Plan for the RI for the Site and first submitted this RI Work Plan to DHEC on October 19, 1990. Following issuance of DHEC's comments on the Work Plan (dated June 7, 1991), National Starch responded to the comments and submitted a revised Work Plan on July 4, 1991. DHEC approved the RI Work Plan in a letter dated August 8, 1991.

The RI Work Plan structured the RI in a phased approach. Phase I of the RI included the following activities:

- preparation of a topographic map;
- completion of a magnetometer survey;
- excavation and removal of drummed waste disposed at the Site;
- collection and analysis of waste samples to develop a Site-specific parameter list for Phase II of the RI; and
- closure of the on-Site hand dug well.

The First Amendment added the following additional tasks to the Phase I RI:

- excavation and stockpiling of additional soils; and

- installation of a flexible membrane liner (FML) at the base of one excavation area.

The RI Work Plan stated that Phase II of the RI would include the installation of groundwater monitoring wells, the collection and analysis of groundwater samples, and the collection of geologic and hydrogeologic data. The RI Work Plan also stated that additional soil sampling and analyses would be included in Phase II of the RI, if warranted by Phase I data.

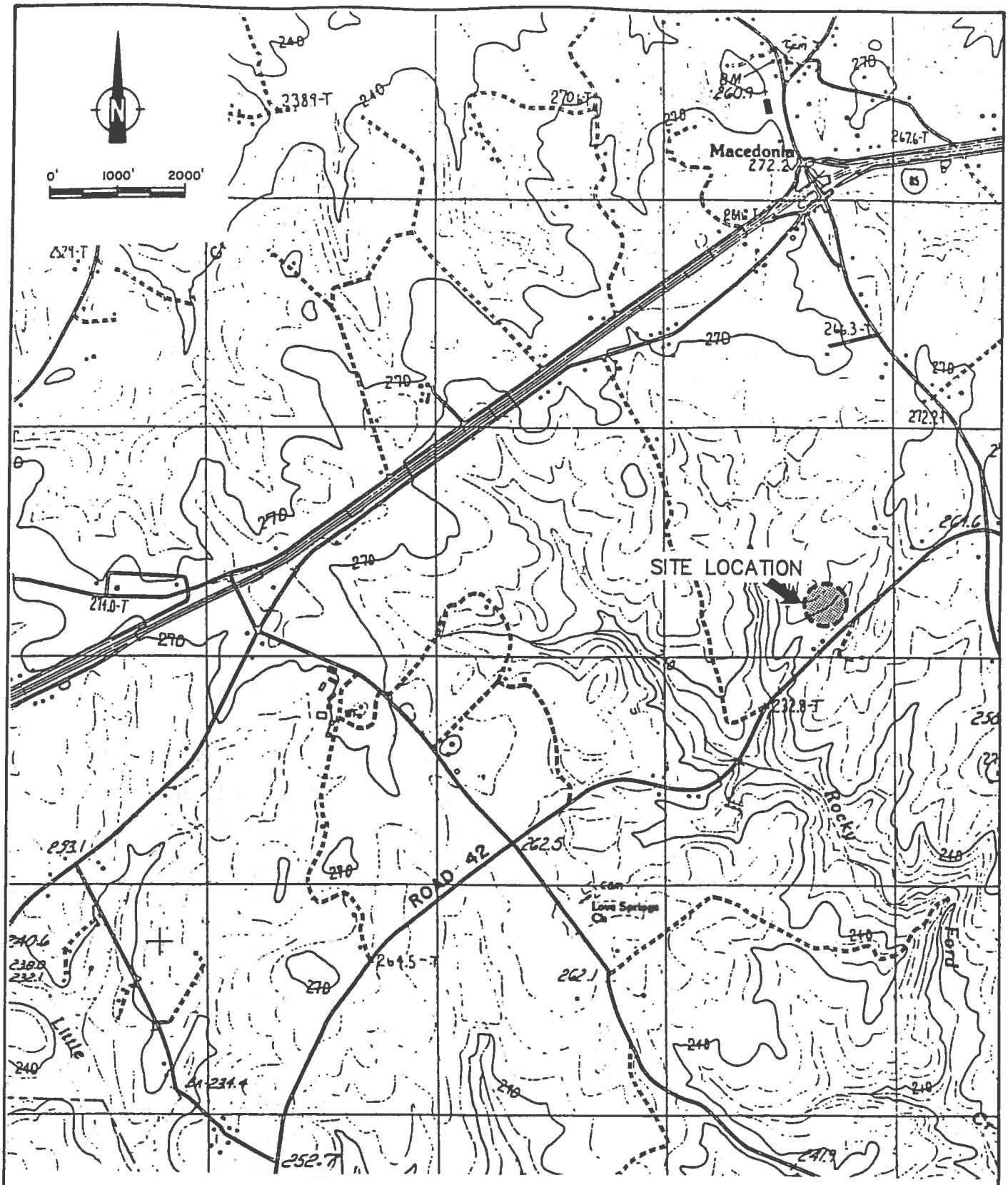
1.1 BACKGROUND

The Site is located in Cherokee County approximately 5.5 miles southwest of the city limits of Gaffney, South Carolina (see Figure 1.1). The Site was operated as a latex waste land disposal facility from May 28, 1976 to July 12, 1976 by Piedmont Industrial Services pursuant to an industrial solid waste disposal permit (IWP-131) issued by DHEC. DHEC inspections during the waste disposal operating period determined that the Site was not operating in accordance with the terms of IWP-131 and, on July 12, 1976, disposal operations at the Site were ordered to cease.

On July 12, 1976, DHEC ordered discontinuance of disposal activities at the Site due to non-compliance with the conditions of IWP-131. This permit was never renewed for this Site.

On December 10, 1984, DHEC staff performed an inspection of the Site. This inspection indicated the presence of an "L" shaped trench with dimensions of approximately 200 feet by 100 feet. The top of the trench was noted to be about 15 to 20 feet wide.

On December 19, 1984, DHEC staff again visited the Site. A metal detector was used at the trench location in order to determine if buried drums potentially were present. Metal was apparently detected 50 feet from the west end of the longer trench section. Also, a drum lid was found approximately 125 feet from the west end of the longer trench section. Four



ADAPTED FROM S & ME RI WORK PLAN

SOURCE: U.S.G.S., COWPENS, S.C.
7.5 MINUTE TOPOGRAPHIC
QUADRANGLE MAP

figure 1.1

SITE LOCATION MAP
REMEDIAL INVESTIGATION PHASE I
LOVE SPRINGS SITE
Cherokee County, South Carolina

CRA

soil samples and one surface water sample were collected during this inspection. Analytical results reportedly indicated the presence of soil contamination at the Site, presumably attributable to the former disposal operation. These data were not provided to National Starch.

Additional monitoring at the Site with the metal detector was performed by DHEC on January 15, 1985 after discussions with concerned citizens living in the area. No additional metal was detected.

On November 5 and 6, 1985, DHEC installed three monitoring wells (LS-1, LS-2, and LS-3). Groundwater samples were collected on March 26, 1986 and analyses indicated the presence of benzene in two of the monitoring wells at concentrations of 1.87 parts per billion (ppb) and 1.83 ppb. Apparently no hydraulic data (water level measurements, well response testing) were collected during this program.

1.2 PHASE I - REPORT ORGANIZATION

The scope of the Phase I Report is described in Section 4.14 of the RI Work Plan. The RI Work Plan stated that the following elements would be included in the Phase I Report.

i) a chronology and description of all activities performed;
ii) identification of any variances from the work plan;
iii) identification of problems encountered and how they were resolved;
iv) an inventory of quantities and types of materials removed and their ultimate disposal;
v) a compilation of all analytical data collected during the Phase I field investigation;
vi) air monitoring records and air sampling results;
vii) drawings showing pre-Phase I and post-Phase I Site conditions
viii) results of the magnetometer survey;
ix) topographical drawing of the Site detailing all pertinent Site features and elevations; and

x) a proposed Site specific analytical parameter list for use in Phase II investigations which was developed following evaluation of all waste characterization data.

In accordance with the requirements, this Phase I Report is organized as follows:

- Section 2.0 summarizes Phase I RI activities completed at the Site;
- Section 3.0 summarizes the waste removal and disposal actions completed at the Site for drums, soil and water;
- Section 4.0 presents a summary of soil and groundwater analytical results generated during Phase I of the RI; and
- Section 5.0 presents the scope of work for Phase II of the RI.

The text of this report identifies variances from the RI Work Plan and how problems were resolved. The information and data presented herein has been previously reported to DHEC through monthly progress reports, which National Starch prepared and submitted on a voluntary basis.

2.0 SUMMARY OF PHASE I RI ACTIVITIES

Figure 2.1 shows the pre-Phase I RI Site conditions. National Starch contracted with Kelchner Environmental, Inc. (Kelchner) to complete the removal and disposal of buried drums at the Site. The contract consisted of the following work:

i) the excavation, staging and off-Site disposal of buried drums;
ii) the staging of visibly stained soils; and
iii) the collection of water produced during decontamination activities.

Prior to mobilizing to the Site, National Starch obtained an access agreement for the RI from the Site's owner, Bowater Resources. The access agreement was dated August 27, 1991 and is presented in Appendix B.

CRA has prepared a photographic log illustrating the progress of Phase I of the RI. This photographic log is presented in Appendix C.

2.1 SITE PREPARATION

Kelchner commenced mobilization to the Site on December 9, 1991. Mobilization included the following activities:

- clearing and grubbing the Site;
- construction of an access road;
- preparation and submission of Kelchner's health and safety plan;
- installation of personnel support and hygiene facilities;
- construction of soil and drum staging pads;
- connection to construction utilities; and
- construction of decontamination facilities.

Mobilization was completed on December 11, 1991.

The Site was cleared utilizing chain saws, brush grubbing equipment, wood chippers and bulldozers (John Deere 650G and Komatsu D37E).

The access road was built from County Road 42 to the trench area following the path shown on Figure 2.2. Trees and brush were cleared utilizing chain saws, brush grubbing equipment and a wood chipper. The access road was cut and graded utilizing a John Deere 650G dozer and subsequently rolled smooth utilizing a vibrating roller.

Kelchner installed an 8-foot high set of chain link locking gates across the Site access road, meeting with tree lines on either side of the access road, adjacent to Route 42. The gates were locked during periods of Site inactivity.

Soil stockpile areas were constructed using a John Deere 650G dozer. The base of these areas was constructed of native soils and was compacted and rolled smooth with a vibrating roller. The stockpile areas were covered with two layers of 6 mil continuous polyethylene sheeting such that the liner overlapped a perimeter containment berm of graded top soil.

Drum staging areas were constructed using a John Deere 650G dozer. The base of these areas was constructed from native soils and compacted and rolled smooth with a vibrating roller. The drum staging areas were covered with 40-mil PVC liner such that the liner overlapped a perimeter containment berm of graded top soil. Sand was imported to the Site and distributed over the liner to a depth of at least eight inches. The sand was graded smooth and a water collection sump installed prior to overlaying the sand with geotextile fabric. Crushed stone was imported to the Site and distributed over the geotextile fabric and compacted smooth utilizing a vibrating roller.

Staging facilities were constructed at the locations shown on Figure 2.2. The staging facilities are identified as follows:

Staging Facility Name	Areal Dimensions	Materials Staged
Soil Stockpile A (SSA)	16 feet x 50 feet	visibly stained soil
Soil Stockpile B (SSB)	40 feet x 100 feet	visibly stained soil
Empty Drum Staging Pad (EDSP)	16 feet x 50 feet	empty drums, rings, lids, drum fragments, scrap metal
Drum Staging Pad (DSP)	75 feet x 100 feet	drums

Monitoring wells LS-1, LS-2 and LS-3 were found by CRA during the Site preparation activities. The locations of these wells are shown on Figure 2.2. Wooden well barricades were built around wells LS-2 and LS-3 to prevent them from being damaged during excavation activities. The hand dug well was also found by CRA at the location shown on Figure 2.2. The hand dug well was covered with plywood and cordoned off with yellow caution tape.

2.2 PRE-EXCAVATION INVESTIGATIVE ACTIVITIES

On December 17, 18 and 20, 1991, Jack R. Christian and Associates Surveying completed a topographical survey of the Site and established benchmarks, Site boundaries and a 50-foot interval horizontal Site control grid (50 feet by 50 feet). Figure 2.3 presents the topographic survey of the Site.

On December 19 and 20, 1991, LGI, a division of Layne Geo Services, Inc., completed a magnetometer survey over the Site in order to delineate the presence of buried drums. The survey was completed by utilizing an EGG 856 proton procession magnetometer to obtain readings of total magnetic strength at the established grid stations.

The results of the magnetometer survey indicated that there were 9 major anomalous areas as shown on Figure 2.4 and detailed in Table 2.1. Total magnetic field readings throughout the remainder of the Site were indicative of the ambient background magnetic field.

TABLE 2.1

GEOPHYSICAL SURVEY RESULTS
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Anomaly	Grid Reference	Description
1	4+00/50R	Small, localized anomaly, could be single drum or buried scrap.
2	4+00/150R	Medium anomaly extending southwest from the grid reference, just south of hand-dug well; potentially several buried drums, or construction related debris.
3	3+00/100R	Large, broad anomaly extending south and east of the grid reference; very high potential of buried drums in this region.
4	1+50/100R	Very large, broad anomaly extending diagonally from grid reference 1+50/50R to 2+00/150R; anomaly is located mainly under western entrance to the trench feature, and extends approximately 100 feet along the bottom of the trench. In addition, the anomaly extends under the southern bank of the trench. Very high potential for buried drums underlying this region.
5	2+00/250R	Medium anomaly extending south and west of the grid reference; potential for a few buried drums or construction debris.
6	2+50/300R	Small anomaly extending northwest and southwest from the grid reference; small potential for buried drums.
7	2+00/300R	Small anomaly centered around the grid reference; small potential for buried drums; may be caused by nearby monitoring well.
8	2+00/400R	Small anomaly centered at grid position 2+25/387.5R; small potential for buried drums.
9	1+00/150R	Small anomaly extending west from the grid reference; small potential for buried drums; may be caused by nearby monitoring well.

pressure washer on the equipment decontamination pad. Upon completion of the last excavation, a final decontamination of equipment used in the Exclusion Zone was performed on the equipment decontamination pad. Decontamination of the equipment consisted of hand shoveling to remove loose dirt and debris and a high pressure water wash. Particular attention was paid to decontaminating joints, sprockets and undercarriages.

2.4 DRUM EXCAVATION

Drum excavation activities commenced on January 21, 1992. Excavations were completed utilizing a John Deere 790LC track hoe equipped with an earth excavation non-teethed bucket. Excavations were completed systematically in one-foot lifts from existing ground surface to a depth at least three feet into native undisturbed soil. Excavations originated at the north section of test pit TP-4 and proceeded in a southerly direction.

During excavation activities, soil that was not visibly stained was stockpiled adjacent to the excavation area. Visibly stained soils encountered during excavation activities were transported directly from the trench to soil staging pads utilizing a CAT 426 rubber tired back hoe. Two laborers in Level B PPE, including PVC suits, were stationed at the base of the excavation. These laborers assisted in the following excavation activities: guiding the track hoe operator; manually loading the track hoe bucket with drum fragments, lids and rings; digging around drums with hand shovels to prevent the bucket from damaging the drums; and overpacking drums found to be containing two inches or more of material (i.e. not empty). Empty drums, crushed drums, drum bottoms, drum fragments, lids and rings encountered during excavation activities were counted, recorded and transported to the EDSP utilizing a CAT 426 rubber tired backhoe.

Drums containing more than two inches of material were overpacked into 85-gallon drums. Drums to be overpacked were labeled, recorded and photographed. A total of 290 drums was overpacked and staged on the DSP. Overpacked drums were removed from the trench utilizing

slings and chains and transported to the DSP utilizing a CAT 426 rubber tired backhoe.

As each drum was excavated, Kelchner completed an inspection of each drum to record the following:

- drum number, assigned at time of inspection (D0001 to D0290);
- drum size, color, type, condition, contents and location;
- drum labeling information (if present);
- total organic vapor concentration, measured with a photoionization detector (PID);
- lower explosive limit and percent oxygen, measured with an explosimeter;
- radioactivity, measured with a dosimeter; and
- cyanide/sulfide vapor concentration, measured with hand held cyanide/sulfide monitors.

Prior to deeming excavations complete, test excavations were dug at the base of the excavations to ensure that the excavations were deep enough and included a large enough area to have encountered the drums associated with each magnetic anomaly.

A total of 21 separate excavations (19 test pits and 2 main trenches) were completed in the locations shown on Figure 2.6 Various metal objects and containers were removed from the test pits as indicated in Table 2.2. Of the 290 drums excavated, all were removed from TP-4.

An additional 16 drums were excavated from TP-4 during the installation of the FML liner, discussed in Section 2.11.

2.5 AIR MONITORING

During the progress of active work, air quality was monitored in and around each active work location. Monitoring was conducted regularly on a daily basis utilizing an HNu systems PID for volatile

organic vapors. The results of the air monitoring program were recorded on daily work sheets and are presented by excavation in Table 2.2.

2.6 DRUM SAMPLING

CRA commenced drum sampling on February 22, 1992. Drum sampling was completed to determine the appropriate methods of disposal and to ensure that drummed materials were consolidated in a safe manner for transport and disposal. Drums were sampled in the manner presented below.

- Solids/Semisolids: Solids were sampled with stainless steel mixing spoons or a stainless steel trier. Where possible, the spoon or trier was forced through the material to a depth of 12 inches or refusal. If the material in the container was too elastic, it was cut with a knife. If the material was too hard to collect a sample in this manner, the material was chipped using a brass hammer and a brass chisel. Once a sample of the material was collected, it was placed into a 16-ounce sample jar.

- Liquids: Liquids were sampled using 4-foot sections of glass pipette. The pipette was lowered into the drum, until the bottom of the drum was reached. The sampler would place their thumb over the end of the pipette and remove it from the container. The contents of the pipette were then released into a 16-ounce sample container.

Sludges or solids underneath a liquid were sampled by forcing the pipette into the solid layer. The pipette was then removed from the container and the material was released into the sample container. If the material would not run out of the pipette, the pipette was broken and the pieces were placed into the sample container.

After a group of drums had been sampled, the sampling waste, sample gloves and pipettes were collected and placed into overpack drums for disposal.

COMPATIBILITY GROUPS
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Waste Code	Waste Compatibility Grouping	Representative Physical Description	Number of Drums
A	Non-Flammable Solids	rubbery, gel/glue/paste/latex-like	138
B	Flammable Solids	rubbery, paste/latex-like	54
C	Non-Flammable Aqueous Liquids	low viscosity, opaque, pumpable	21
D	Non-Flammable Organic Liquids	translucent, viscous	3
E	Flammable Aqueous Liquids	(no drums)	0
G	Water Reactives	translucent/transparent, pumpable	2
H	Flammable Halogenated Solids	latex-like	11
I	Non-Flammable Halogenated Solids	rubbery, paste/latex-like	15
J	Non-Flammable Halogenated Liquids	low viscosity, opaque, pumpable	4
K	Non-Flammable Sulfide Bearing Solids	sticky paste/gel, latex-like	11
L	Non-Flammable Sulfide Bearing Liquids	medium viscosity, opaque, pumpable	1
M	Cyanide Solids	rubbery, paste, glue/latex-like	8
N	Flammable Organic Liquids	low viscosity, pumpable	4
O	Cyanide Liquids	(no drums)	0
P	Flammable Halogenated Liquids	low viscosity, transparent, pumpable	1
Solid/Liquid Waste Mixtures			
A & C	Non-Flammable Solids & Aqueous Liquids	granular paste, latex-like & low viscosity, opaque, pumpable	11
A & D	Non-Flammable Solids & Organic Liquids	latex-like & low viscosity, pumpable	1
E & B	Flammable Aqueous Liquids & Solids	translucent, pumpable & granular	1
E & N	Flammable Aqueous & Organic Liquids	low viscosity, clear, pumpable	1
I & J	Non-Flammable Halogenated Solids & Liquids	hard, crystalline & low viscosity, opaque, pumpable	1
K & L	Non-Flammable Sulfide Bearing Solids & Liquids	granules & low viscosity, translucent, pumpable	1
M & O	Cyanide Solids & Liquids	fine sediment & low viscosity, translucent, pumpable	1
		TOTAL DRUMS	**290**

Note: Drum waste code F (peroxides) wastes were amalgamated with code A and B.

- Mass Spectrometer Tentatively Identified Compounds (TICs);
- total petroleum hydrocarbons (TPHs); and
- specific gravity, paint filter test and physical description.

Appendix D presents the analytical results of drum disposal characterization.

2.8 DRUM DISPOSAL

On September 14, 1993, DHEC approved the off-Site disposal of the 290 drums at the Laidlaw facility in Reidsville, North Carolina. These drums were transported off Site on September 29 and 30, 1993.

2.9 SOIL SAMPLING

CRA sampled the excavated, visibly stained soils stockpiled on the soil staging pads. The base of the disposal trench was sampled approximately once every 50 feet. At each sampling location, one sample was collected of the disturbed soils within the trench while a second sample was collected directly beneath the first in native, undisturbed soil, in accordance with the requirements of the RI Work Plan.

Soil sampling was conducted between January 19 and February 24, 1992. As sampling was being conducted, HNu monitoring was performed. A visual description of the soil that was sampled is provided in Table 2.4, as well as the results of the HNu monitoring. Soil samples were submitted for analyses for the following parameters: TCL VOCs, TCL BNAs, TCL Pesticides, TCL PCBs and TAL Metals.

The equipment cleaning provisions of the RI Work Plan were adhered to for Phase I soil sampling. These provisions included the following:

- clean water wash;

TABLE 2.4

SAMPLE SUMMARY
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Sample Identification	*Date*	*Time*	*Sample Location*	*Depth (feet)*	*Description*	*HNu (ppm)*	*Sample Analysis Performed*
S-3144-011992-WW-01	01-19-92	12:30	Test Pit-1	5.0	Yellow, gray, sandy soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-02	01-19-92	12:50	Test Pit-2	4.0	White, gray, sandy soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-02MS	01-19-92	12:50	Test Pit-2	4.0	White, gray, sandy soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-02MSD	01-19-92	12:50	Test Pit-2	4.0	White, gray, sandy soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-03	01-19-92	12:50	Test Pit-2	4.0	Duplicate of S-3144-011992-WW-02	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-04	01-19-92	01:30	Test Pit-5	4.0	Red, brown soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-05	01-19-92	01:45	Test Pit-7	5.0	Yellow, red soil	2 - 4	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-011992-WW-06	01-19-92	02:00	Trench A	7.0	Purple, black, white, yellow soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-07	02-02-92	01:00	Trench A	2.0	Brown, red soil	3	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-08	02-02-92	01:30	Trench A	6.0	Yellow, red soil	3	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-09	02-02-92	02:00	Trench A	1.0	Brown, red soil	3	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-10	02-02-92	02:30	Trench A	7.0	Yellow, red soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-11	02-02-92	03:00	Trench B	2.0	Brown, black soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-12	02-02-92	03:30	Trench B	7.0	White, purple, red soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-13	02-02-92	04:00	Trench B	2.0	Yellow, red soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-14	02-02-92	04:30	Trench B	6.0	White, purple, red soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-15	02-02-92	05:00	Trench B	2.0	Red, yellow soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-16	02-02-92	05:30	Trench B	6.0	White, purple, red soil	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-020292-WW-17	02-02-92	05:30	Trench B	6.0	Duplicate of S-3144-020292-WW-16	3 - 5	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-021992-WW-18	02-19-92	10:30	North of drum staging pad	4.0	Red, brown soil (background)	0	VOCs, BNAs, Pesticides/PCBs, Metals, CN
W-3144-022192-SD-19	02-21-92	09:15	Field (rinse) blank	N/A	Quality Control (QC)	N/A	VOCs, BNAs, Pesticides/PCBs, Metals, CN
W-3144-022192-SD-20	02-21-92	09:45	Field (rinse) blank	N/A	Quality Control (QC)	N/A	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-21	02-21-92	01:00	Test Pit-4	2.0	Red, yellow soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-22	02-21-92	01:15	Test Pit-4	6.0	Pink, white yellow, red, black soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-23	02-21-92	01:30	Test Pit-4	2.0	White, yellow, red soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-23MS	02-21-92	01:30	Test Pit-4	2.0	White, yellow, red soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-23MSD	02-21-92	01:30	Test Pit-4	2.0	White, yellow, red soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-24	02-21-92	01:45	Test Pit-4	7.0	Red, yellow, gray black soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-25	02-21-92	01:45	Test Pit-4	7.0	Duplicate of S-3144-022192-WW-24	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-26	02-21-92	02:15	Test Pit-4	2.0	Red, yellow soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-27	02-21-92	02:30	Test Pit-4	6.0	Red, yellow, brown soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-28	02-21-92	02:45	Test Pit-4	2.0	Yellow, white, red soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022192-WW-29	02-21-92	03:00	Test Pit-4	6.0	Light brown, yellow, black soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022292-WW-30	02-22-92	12:45	Decontamination pad	N/A	Stones and brown, red soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022292-WW-31	02-22-92	01:30	Access road	N/A	Stones and gray sand	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
W-3144-022292-WW-32	02-22-92	03:15	Field (rinse) blank	N/A	Quality Control (QC)	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-33	02-24-92	08:30	Test Pit-8 Stockpile	N/A	Red, yellow, brown soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-34	02-24-92	08:30	Test Pit-8 Stockpile	N/A	Duplicate of S-3144-022492-WW-33	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-35	02-24-92	09:00	Test Pit-8	2 - 5	Red clay with yellow streaks	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-36	02-24-92	11:15	Visually stained Stockpile A	N/A	Red, brown, yellow soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-37	02-24-92	11:45	Visually stained Stockpile B	N/A	Red, brown, yellow soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
S-3144-022492-WW-38	02-24-92	12:15	Visually stained Stockpile B	N/A	Red, brown, yellow soil	—	VOCs, BNAs, Pesticides/PCBs, Metals, CN
W-3144-022792-WW-39	02-27-92	01:45	Abandoned well (water) *	27-28	Red, cloudy water	—	VOCs, BNAs
S-3144-022792-WW-40	02-27-92	03:15	Abandoned well (sediment)	30.2	Red, sandy sediment	—	VOCs, BNAs

** Water level: 27.24', pH: 8.5, Conductivity: 1.16 us/cm, Well depth: 30.10', Temperature: 73.5° F*

1) VOCs - Volatile Organic Compounds
2) BNAs - Base Neutral Acids (Semi-VOCs)
3) PCBs - Polychlorinated biphenyls
4) CN - Cyanide

These test trenches revealed no additional buried drums. Inspection of the area suggests that the new drums were associated with the previously excavated drums and not the result of subsequent on-Site disposal following initial drum excavation.

Thus, of the total 306 drums excavated at the Site, all were associated with TP-4.

Once the new drums were excavated and test trenching was completed, CRA directed Kelchner to complete the TP-4 preparations and install the HDPE liner. The liner installation commenced on October 14 and was completed on October 16, 1993. The lined TP-4 was subsequently backfilled.

CRA collected samples from the 16 new drums on October 17, 1993 for compatibility analyses. The compatibility results indicated that these drums contained waste materials similar to the drums recently transported off Site to Laidlaw. The compatibility results are summarized in Appendix D.

Due to the revised requirements of 49 CFR 172, effective October 1, 1993, National Starch is now required to be qualified to sign Uniform Hazardous Waste Manifests as a generator of hazardous waste. National Starch is currently completing this training qualification so that the remaining 16 new drums can be transported off Site in accordance with 49 CFR 172. Once National Starch has acquired the appropriate qualifications, these drums will be transported off Site for disposal at Laidlaw.

2.12 WELL CLOSURE

On October 13, 1993, Kelchner directed its subcontractor, Nu-Way Environmental Inc., to abandon the on-Site hand dug well, in accordance with Section 4.11.3 of the RI Work Plan. The well was abandoned using continuous cement bentonite grout up to the existing grade.

3.0 WASTE REMOVAL AND DISPOSAL

The Phase I RI activities generated three types of materials that were ultimately disposed of off Site: drummed waste; visibly stained soils; and decontamination liquids.

Hazardous materials transported off Site for disposal were manifested under Uniform Hazardous Waste Manifest protocols. These manifests were signed in accordance with the requirements of docket HM126F in 49 CFR 172 Subpart H.

3.1 DRUMS

A total of 306 drums were excavated from the Site. All drums were transported off Site in box vans for disposal at the Laidlaw facility in Reidsville, North Carolina. Appendix D presents the Uniform Hazardous Waste Manifests for these shipments.

3.2 SOILS AND DEBRIS

Approximately 850 cubic yards of visibly stained soils were generated by drum excavation and staging activities. These soils were segregated from non-stained soils during drum operations which were ultimately replaced into the drum excavations.

The visibly stained soils are currently stockpiled on Site. These soils will be addressed as part of the Feasibility Study.

Approximately 60 cubic yards of drum staging pad materials were transported off Site in roll-off boxes under tarpaulins for disposal at the Laidlaw facility in Reidsville, North Carolina.

Appendix E presents the records for these off-Site debris shipments.

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TABLE 3A

SOIL SAMPLE ANALYTICAL RESULTS
AREAS OF EXCAVATION
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Sample Identification	WW-01 TP-1	WW-02 TP-2	WW-03 TP-2	WW-04 TP-5	WW-05 TP-7	WW-21 TP-4	WW-22 TP-5	WW-23 TP-6	WW-24 TP-7	WW-25 TP-8	WW-26 TP-9	WW-27 TP-10	WW-28 TP-11	WW-29 TP-12	WW-35 TP-8	TM-01 TP-4	TM-02 TP-4
TCL/TAL Parameters (1,2)																	
VOCs																	
acetone	ND	ND	ND	ND	ND	6U	18U	16U	220	ND	ND	3U	9U	8U	10U	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND	ND	ND	46J	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethene(total)	ND	ND	ND	ND	ND	ND	ND	ND	48	ND	ND	ND	ND	ND	ND	ND	280
methylene chloride	ND	ND	ND	ND	ND	6J	ND	ND	12J	ND	ND	ND	3J	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	1,100J	57,000J	3J	ND	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	54
xylenes(total)	ND	ND	ND	ND	ND	ND	ND	ND	23J	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs																	
acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	82J	ND	ND	ND	ND	ND	NA	NA
di-n-butyl phthalate	ND	ND	ND	ND	ND	1,700U	1,600U	400U	1,600U	3,400U	3,100U	3,900U	3,800U	790U	250J	NA	NA
2-methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	41J	280J	ND	ND	ND	ND	ND	NA	NA
naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	140J	1,400J	ND	ND	ND	ND	ND	NA	NA
phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Metals																	
aluminum	7,900	13,000	7,700	17,000	30,000	66,000	12,000	9,500	17,000	26,000	19,000	16,000	25,000	16,000	41,000	NA	NA
arsenic	1.9	ND	ND	7.3	2.3	ND	1.2	ND	ND	ND	ND	ND	3.3	ND	ND	NA	NA
barium	8	30	30	41	29	57	57	29	170	120	58	90	21	36	29	NA	NA
beryllium	0.61	1.2	0.99	0.35	0.42	0.60	0.66	0.40	0.98	0.71	1.6	0.82	1.1	1.6	ND	NA	NA
cadmium	ND	4.9	ND	ND	ND	ND	ND	1.1	ND	ND	1.7	0.9	ND	1.2	ND	NA	NA
calcium	ND	ND	ND	650	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
chromium	42	70	65	34	62	71	22	23	24	33	16	28	22	17	57	NA	NA
cobalt	5.7	19	21	ND	ND	ND	18	4.6	19	14	15	15	ND	18	ND	NA	NA
copper	110	44	42	15	16	33	21	33	25	22	74	33	38	47	21	NA	NA
iron	44,000	89,000	68,000	32,000	38,000	56,000	38,000	28,000	47,000	45,000	66,000	42,000	52,000	52,000	48,000	NA	NA
lead	1.8	2.4	2.5	12	9.5	15	12	34	140	40	79	26	33	160	9.1	NA	NA
magnesium	ND	ND	ND	ND	ND	660	1,200	560	380	420	ND	ND	ND	ND	ND	NA	NA
manganese	220	1,200	1,100	210	65	200	700	69	2,000	990	780	1,400	140	600	64	NA	NA
mercury	ND	ND	ND	ND	ND	0.2	ND	ND	ND	0.2	ND	ND	ND	ND	ND	NA	NA
nickel	ND	ND	ND	ND	0.10	12	7.5	5.4	28	11	21	23	4.7	14	5.9	NA	NA
potassium	6.9	29	23	3.4	3.9	990	1,200	540	360	500	350	320	480	ND	7,800	NA	NA
thallium	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND	ND	ND	ND	ND	ND	NA	NA
vanadium	81	69	57	52	75	120	79	38	80	81	78	60	80	64	74	NA	NA
zinc	15	41	30	25	16	38	28	18	37	29	50	36	35	48	14	NA	NA
total cyanide	ND	ND	ND	430	390	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA

Notes:

NA	Denotes that compound was not analyzed for.
ND	Denotes that compound was not detected above method detection limits.
U	The material was analyzed for but was not detected above the sample quantitation limit.
J	Denotes that results are estimated.
(1)	Organic concentrations reported in µg/kg; Metal concentrations reported in mg/kg.
(2)	The analytical results reported on this table include the total list of compounds/analytes detected in all RI Phase I samples.

TABLE 4.1
SOIL SAMPLE ANALYTICAL RESULTS
AREAS OF EXCAVATION
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Sample Identification	WW-06 Trench A	WW-07 Trench A	WW-08 Trench A	WW-09 Trench A	WW-10 Trench A	WW-11 Trench B	WW-12 Trench B	WW-13 Trench B	WW-14 Trench B	WW-15 Trench B	WW-16 Trench B	WW-17 Trench B
TCL/TAL Parameters (1,2)												
VOCs												
acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethene(total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
xylenes(total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs												
acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	52	ND	ND	ND
butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals												
aluminum	7,400	36,000	24,000	2,700	3,800	13,000	13,000	29,000	6,100	33,000	9,100	8,100
arsenic	ND	ND	6.3	7.0	9.0	4.3	ND	ND	ND	ND	ND	ND
barium	43	52	20	33	34	35	33	36	52	24	83	56
beryllium	0.58	0.71	0.80	0.43	0.61	0.49	0.89	0.56	0.39	0.38	0.51	0.44
cadmium	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
calcium	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium	26	49	56	50	48	86	35	38	10	40	20	9.6
cobalt	10	7.2	6.5	ND	ND	ND	6.4	3.1	9.7	ND	17	12
copper	13	26	43	15	21	11	9.1	20	4.0	18	15	13
iron	24,000	50,000	72,000	31,000	40,000	20,000	38,000	29,000	13,000	30,000	24,000	18,000
lead	4.8	9.1	16	9.5	11.5	14	9.4	11	13	11	27	34
magnesium	1,400	1,000	ND	ND	450	ND	2,000	500	1,100	ND	1,300	910
manganese	310	330	130	91	62	81	100	120	730	60	1,200	940
mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
nickel	ND	10.0	5.7	4.0	7.4	5.6	9.6	7.0	4.6	4.2	19	14
potassium	7.8	1,600	ND	410	580	330	2,800	770	1,800	360	1,800	1,200
thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
vanadium	35	81	110	55	75	44	45	62	16	65	42	29
zinc	25	30	51	27	36	29	45	120	33	32	56	42
total cyanide	2,000	ND	ND	ND	0.7	ND	ND	ND	ND	ND	0.6	0.7

Notes:

NA	Denotes that compound was not analyzed for.
ND	Denotes that compound was not detected above method detection limits.
U	The material was analyzed for but was not detected above the sample quantitation limit.
J	Denotes that results are estimated.
(1)	Organic concentrations reported in µg/kg; Metal concentrations reported in mg/kg.
(2)	The analytical results reported on this table include the total list of compounds/analytes detected in all RI Phase I samples.

TABLE 4.2
SOIL SAMPLE ANALYTICAL RESULTS
NON-EXCAVATION AREAS
LOVE SPRINGS SITE
CHEROKEE COUNTY, SOUTH CAROLINA

Sample Identification	WW-18 Background	WW-30 Decon Pad	WW-31 Access Road	WW-33 TP-8 Stockpile	WW-34 TP-8 Stockpile	WW-36 Soil Stockpile A	WW-37 Soil Stockpile B	WW-38 Soil Stockpile B
TCL/TAL Parameters (1,2)								
VOCs								
acetone	11J	ND	ND	11U	5U	ND	ND	5U
2-butanone	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	ND	4J	ND	ND	ND	ND	ND	ND
1,2-dichloroethene(total)	ND	ND	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND	2,300	ND	5J
toluene	ND	ND	ND	ND	ND	ND	ND	ND
xylenes(total)	ND	ND	ND	ND	ND	ND	ND	ND
BNAs								
acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND
butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND
di-n-butyl phthalate	ND	500	890	ND	120J	830J	250J	250J
2-methylnaphthalene	ND	ND	ND	ND	ND	84J	280J	300J
naphthalene	ND	ND	ND	ND	ND	530J	790	750
phenanthrene	ND	75J	ND	ND	ND	ND	ND	ND
Metals								
aluminum	42,000	22,000	15,000	10,000	13,000	16,000	20,000	16,000
arsenic	3.5	3.5	12	ND	4.5	ND	ND	ND
barium	28	29	62	27	24	69	140	140
beryllium	0.73	ND	0.37	0.4	ND	0.51	0.8	0.56
cadmium	2.5	ND	ND	ND	ND	ND	ND	ND
calcium	ND	27,000	150,000	ND	ND	ND	ND	ND
chromium	95	29	27	42	30	27	22	26
cobalt	ND	ND	9.2	4.6	4.6	11	35	27
copper	31	17	17	19	17	23	35	24
iron	66,000	35,000	13,000	36,000	37,000	46,000	38,000	45,000
lead	ND	11	2.7	7.4	7.8	23	17	18
magnesium	ND	14,000	52,000	820	710	450	510	580
manganese	160	150	240	91	150	550	2,700	2,300
mercury	ND	0.1	ND	ND	ND	ND	ND	ND
nickel	9.3	5.2	16	5.6	3.9	7.7	24	16
potassium	500	1,100	9,500	1,300J	22,000J	12,000	12,000	14,000
thallium	ND	ND	ND	ND	ND	ND	14	14
vanadium	120	49	31	44	57	59	51	62
zinc	29	15	14	22	16	34	36	29
total cyanide	ND	ND	ND	ND	ND	ND	ND	0.1

Notes:

ND	Denotes that compound was not detected above method detection limits.
U	The material was analyzed for but was not detected above the sample quantitation limit.
J	Denotes that results are estimated.
(1)	Organic concentrations reported in µg/kg; Metal concentrations reported in mg/kg.
(2)	The analytical results reported on this table include the total list of compounds/analytes detected in all RI Phase I samples.

- RI Work Plan, Section 4.12;
- RCRA corrective action levels, identified in "EPA Proposed Corrective Action Rule for Solid Waste Management Units (55 FR 30798; July 27, 1990)"; and
- concentration-based exemption criteria, identified in "Federal Register/Vol. 57, No. 98/Wednesday, May 20, 1992/Proposed Rules".

The evaluation and interpretation concluded the following:

> All soil samples exhibited concentrations below the CBEC level of 800 mg/kg (for tetrachloroethylene or PCE). This suggests that the soils these samples represent could be disposed of at a Subtitle D Landfill. However, four of these five soil samples displayed concentrations below the proposed action level of 10 mg/kg. These four data points demonstrate that the United States Environmental Protection Agency would not consider the site soils to be subject to corrective action under the proposed corrective action rules. The fifth soil sample displayed a qualified estimated concentration of 57 mg/kg. This qualified data point (an approximate concentration) is the only exceedence of the proposed corrective action level for PCE and this single data point should not form the basis of a conclusion that corrective action is required. The entire database strongly suggests that these soils do not present a potential threat to human health and the environment. (See CRA letter to DHEC, August 20, 1992, in Appendix G).

DHEC ultimately concurred with CRA's interpretation in the First Amendment. However, DHEC directed National Starch to collect two additional soil samples from the base of TP-4 to confirm that this area had not been impacted by historical disposal activities and to install the FML in TP-4 once visibly stained soils had been removed.

CRA collected these two additional soil samples on September 23, 1993 from the locations shown on Figure 4.2. These soil samples were analyzed for TCL VOCs. The analytical results are summarized in Table 4.1.

5.0 PHASE II RI SCOPE OF WORK

The Phase II RI scope of work is presented in the RI Work Plan. The RI Work Plan states that

.... (w)ork tasks to be performed during Phase II include:

1. Installation of three new groundwater monitoring wells;
2. Collection of two rounds of groundwater samples from all new and existing monitoring wells with analyses for parameters in the Target Analyte List (TAL) and in the Target Compound List (TCL). If appropriate, additional groundwater sampling and analysis beyond the two rounds planned may be completed following completion of Phase II and a review of the analytical data;
3. Determination of in situ hydraulic conductivity of the saprolite (overburden) by completion of response tests at each monitoring well;
4. Collection of soil samples from boreholes installed for the new monitoring wells for grain size distribution analyses;
5. Completion of a water well inventory within a one mile radius of the Site;
6. If required, additional soil sampling and analyses to fully delineate the extent of residual soil contamination.

This Section provides additional details for the Phase II RI scope of work, where necessary, and proposes modifications to the scope of work presented in the Work Plan.

Phase II of the RI will determine the hydrogeology of the Site and determine the impact, if any, of past waste disposal at the Site on groundwater quality. In addition, a risk assessment will be performed. Analyses conducted in Phase II will be completed according to the SSPL presented in Section 4.0.

Modifications proposed to the Phase II Scope of Work presented in the Work Plan include:

1) the completion of a confirmatory magnetometer survey;
2) completion of five soil borings in the area of TP-4; and
3) collection of two rounds of surface water samples from the stream south of the former disposal trench.

5.1 INVESTIGATIVE DRILLING

The analytical data reported in Tables 4.1 and 4.2 indicate that the majority of Site soils which were impacted by historic drum disposal activities have been removed and stockpiled. However, drum burial was focused at the TP-4 location and characterization of the soils surrounding this area is appropriate in order to evaluate if the past drum disposal activities have impacted Site soils beyond the limits of the excavation.

Four soil borings will be installed around the perimeter of the TP-4 area. These soil borings will be used to characterize the geologic conditions underlying the Site and to determine if horizontal contaminant migration has occurred. A fifth soil boring will be installed in a location removed from Site excavation activities and drum burial (a "background" location). Figure 5.1 illustrates the locations of the five soil borings.

The soil borings will be installed to a maximum depth of 30 feet. Continuous split-spoon soil samples will be collected to the base of each boring. One soil sample will be selected for analyses from each soil boring, based on visual and PID screening of the samples. These samples will be analyzed for the SSPL.

5.2 GROUNDWATER MONITORING WELL INSTALLATION

Three monitoring wells will be installed at the Site in accordance with the RI Work Plan. These wells will be used to characterize

the geologic and hydrogeologic conditions underlying the Site and to determine if groundwater contamination has resulted from previous Site operations. The well installation program will:

- define the subsurface geology of the Site;
- define aquifers which are present in the saprolite;
- determine the hydraulic conductivity of the saprolite;
- verify the groundwater flow patterns as determined in Phase I;
- verify the horizontal hydraulic gradient within the saprolite; and
- provide for the collection of soil and groundwater samples for physical and chemical analyses.

Figure 5.1 illustrates the installation locations of the three monitoring wells. Permits will be obtained from the State of South Carolina prior to the installation of the monitoring wells. Specific construction procedures, such as drilling, monitoring well installation, well development and equipment cleaning, are detailed in the RI Work Plan.

5.3 COLLECTION OF HYDRAULIC DATA

5.3.1 Response Testing

In situ hydraulic conductivity testing will be completed to determine the hydrogeologic properties of the saprolite. Single well response tests will be performed at each new and existing monitoring well. These tests involve changing the water level within a well and monitoring the time required for the level to return to the static position. Two types of response tests are normally performed, namely falling head tests, where a slug of known volume is introduced into the standing water column, and rising head tests, where a known volume of water is removed from the well and the recharge is monitored.

Several methods have been developed for determination of hydraulic conductivity values from response test data. These methods consider well morphology, hydrogeologic setting, and time lag response as